Rural-Urban Difference in Plasma Lipid Levels and Prevalence of Dyslipidemia in Hausa-Fulani of North-Western Nigeria

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Objectives: To compare the serum lipids levels, prevalence of dyslipidaemia, and adiposity of rural versus urban dwellers in Sokoto, Nigeria.

Methods: A cross-sectional study was conducted in both rural and urban areas of Sokoto, Nigeria. One hundred participants were recruited using a multi-stage sampling method. Demographic data and anthropometric measurements were obtained. Fasting blood was drawn for assessment of total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL-C) and low-density lipoprotein (LDL-C) cholesterol. The classification of dyslipidemia was based on the National Cholesterol Education Program-Adult Treatment Panel guidelines.

Results: The (mean [SD]) waist circumference of the urban participants (83.8 [9.5] cm) was significantly higher than the rural participants (79.2 [11.2] cm) (P=.030). The mean BMI of the urban participants (23.9 [3.9] kg/m^2) was higher than the rural participants (22.2 [3.7] kg/m^2) (P=.09). The mean TC was significantly higher in urban (175.9 [49.6] mg/dL) than rural participants (148.3 [24.3] mg/dL) $P<.001$. Mean serum LDL-C, and TG concentrations were higher in the urban than rural participants but the difference was not statistically significant. Mean serum HDL-C was also insignificantly higher in the rural (51.1 [7.9] mg/dL) than in urban participants (50.2 [11.7] mg/dL) (P=.64). The most frequent dyslipidemia was abnormally low HDL-C (13%) and this was more common in the urban participants (16%) than in rural participants (10%).

Conclusion: This study demonstrated that compared to the rural dwellers, the urban dweller were more likely to be obese and had higher frequency of adverse plasma lipid profile. This may have implications for rural-urban patterns of lipid related cardiovascular disease. (*Ethn Dis.* 2013;23[3]:374–378)

Key Words: Rural, Urban, Lipids, Dyslipidemia

Introduction

Cardiovascular diseases (CVD) are among the leading causes of death and disability in both developed and developing countries.[1] They are usually due to atherosclerosis of large and medium sized arteries with dyslipidemia or lipid abnormalities being the major risk factors for premature coronary artery disease.[2,3] The benefits of cholesterol lowering have been acknowledged in a number of different treatment recommendations, including the third report of the US National Cholesterol Education Program-Adult Treatment Panel (NCEP-ATP III).[2]

Lifestyle changes, including increased saturated fat consumption and decreased physical activity, which are associated with urbanization, are associated with adverse changes in the lipid profile.[4–6] Community-based studies on the effect of urbanization on plasma lipid levels are lacking in the northern part of Nigeria. In this article, we describe the serum lipid values among urban and rural Hausa-Fulani dwellers in Sokoto State of Nigeria. The rural Hausa-Fulani mostly live in a subsistence economy where they farm and raise cattle. Much of their physical activity is occupational in nature and related to providing food and subsistence to their families. In contrast, the urban Hausa-Fulani have adopted a Western lifestyle with low levels of occupational physical activity.[7] To our knowledge, ours is the first observation of the urban/rural differences in this population.

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Study Design and Methods

In a cross-sectional study, we recruited 100 (50 urban; 50 rural) adults participants out of 232,846 and 179,619 urban and rural participants, respectively, from 2 urban and 2 rural districts of Sokoto state, North-Western Nigeria using a multi-stage sampling method.[8] The first stage sampling units were randomly selected from a list of urban and rural areas in the state. A list of wards and compounds were made from the first stage. A random sample of these second stage units was selected and then studied. Gumbi and Wamakko villages of Wamakko local government were the selected rural areas, while Mabera and Yar'akija areas were the selected urban areas.

Data were obtained using a structured researcher-administered questionnaire. Participants were invited to a designated location for measurements. Using a modification of the World

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Table 1. Anthropometric characteristics of the participants by location, mean (SD)

Variable	All, *N*=100	Urban, *n*=50	Rural, *n*=50	*P*
Weight, kg	61.2 (13.4)	64.9 (13.7)	59.4 (12.5)	.04
Height, cm	164.4 (8.7)	165.7 (8.9)	163.0 (8.4)	.13
BMI, kg/m^2	22.9 (3.8)	23.5 (3.9)	22.2 (3.7)	.09
WC, cm	81.6 (10.6)	83.8 (9.5)	79.2 (11.2)	.03
WHR	.86 (.7)	.87 (.1)	.85 (.1)	.30
SBP, mm Hg	130.2 (15.9)	131.0 (19.4)	129.5 (11.5)	.63
DBP, mm Hg	79.9 (11.5)	80.9 (11.9)	78.9 (11.0)	.40

BMI, Body Mass Index; DBP, diastolic blood pressure; SBP, systolic blood pressure; WC, waist circumference; WHR, waist/hip ratio.

Health Organization (WHO) STEPS-wise approach to surveillance (STEPS),[9] trained research assistants consisting of medical doctors, medical students and laboratory technologists administered the questionnaires and obtained information on sociodemographic data, lifestyle, diet history and family history of diabetes mellitus and hypertension. The WHO STEPwise approach to surveillance (STEPS) is the WHO recommended surveillance tool for chronic diseases risk factors and chronic disease-specific morbidity and mortality. STEPS is a sequential process that starts with gathering key information on risk factors with a questionnaire, then to simple physical measurements and then to more complex collection of blood samples for biochemical analysis. Anthropometric measurements including weight, height, waist and hip circumferences measured with the participants lightly clothed and without shoes. Body mass index and waist–hip ratio were calculated.[10]

Three blood pressure values were obtained with the participant in a seated position after a minimum of 5 min rest using automated validated manometer with cuff size of 14.5–42.0cm (Omron SME-1 Omron Healthcare Ltd, Kyoto, Japan). The average of the last 2 of 3 readings was taken as the blood pressure.

Laboratory Analysis

Biochemical analysis was performed on venous samples obtained after an 8-hour overnight fast. Fasting plasma glucose and lipids were determined on blood drawn. Plasma total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), and triglycerides (TG) were determined respectively by cholesterol esterase/ cholesterol oxidase technique and enzymatic colorimetric techniques using commercial kits made by Biolab S.A France. Plasma levels of low density lipoprotein cholesterol (LDL-C) were derived using the Friedwald formula.[11] Besides obtaining permission and consent from local authorities and individuals respectively, the study protocol was approved by the research and Ethics Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria.

Definitions and Preferred Cut-off Values

The classification of dyslipidemia was based on the NCEP ATP III guidelines.[2] Hypercholesterolemia was defined as TC >200mg/dl, LDL-C as >100mg/dL, hypertriglyceridemia as TG >150mg/dL and HDL-C <40mg/dL. Dyslipidemia was defined by the presence of one or more than one abnormal serum lipid concentration. Hypertension was diagnosed as systolic blood pressure >140 mm Hg and/or diastolic blood pressure >90 mm Hg or in individuals on antihypertensive medication.[12] Obesity was defined as body mass index (BMI) ≥30 kg/m^2. Waist circumference ≥88cm (female) and ≥102cm (males) constituted abdominal adiposity.[10]

Statistical Analysis

Statistical analysis was performed using Epi Info version 3.3.4. Means and standard deviations were determined for quantitative data, and frequencies determined for categorical variables. The Chi-square test was used to analyze group differences for categorical variables while Student's *t* test was used to test the difference between two means and analysis of variance was used to compare multiple means. $P<.05$ was considered statistically significant.

RESULTS

The mean (SD) age of the study population was 39.9 (13.9) years (rural participants: 38.7 [14.3]; urban participants: 40.6 [13.6] years; [P=0.23]). The anthropometric and blood pressure values of the participants are shown in Table 1. The urban participants had significantly higher mean weight and waist circumference. The rural participants had lower systolic and diastolic blood pressures but the differences were

Table 2. Values of major lipids in rural and urban study participants, mean (SD), mg/dL

Lipid	Rural	Urban	*P*
TC	148.28 (24.35)	175.91 (49.6)	<.01
HDL-C	51.14 (7.93)	50.22 (11.8)	.64
LDL-C	89.62 (25.58)	104.22 (50.96)	.071
TG	104.48 (36.39)	109.07 (41.83)	.56

TC, total cholesterol; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; TG, triglyceride.

Table 3. Values of major lipids by sex in study participants, mean (SD), mg/dL

Lipid	Males	Females	*P*
TC	165.08 (50.25)	160.22 (31.33)	.57
HDL-C	48.07 (8.41)	53.13 (10.9)	.01
LDL-C	100.20 (47.91)	94.02 (33.57)	.46
TG	107.71 (41.82)	106.41 (37.27)	.87

TC, total cholesterol; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; TG, triglyceride.

not statistically significant (*P*=.63 and .40, respectively).

The mean values of the major lipids by geographical location are summarized in Table 2. The urban participants had significantly higher total cholesterol than the rural participants. The urban participants had lower values of HDL-C than the rural participants but the difference was not statistically significant (*P*=.64). The mean values of the major lipids by sex are summarized in Table 3. The males had significantly lower HDL-C than the females (*P*=.01).

The relationships between age and lipid levels are presented in Table 4. The mean TC, LDL-C and TG levels generally increased with advancing age. The urban participants had higher TC and LDL-C levels compared to their rural population of the same age groups. The urban participants had lower values of TG than the rural participants in the younger age group, however the plasma TG levels were higher in the older age group of the urban population.

The prevalence of dyslipidemia using NCEP ATP III criteria is summarized in Table 5. The prevalence of borderline high/high TC, TG and LDL-C were higher in the urban than rural participants.The most frequent dyslipidemia was abnormally low HDL-C (13%) and this was more common in the urban participants (16%) than in rural participants (10%).

DISCUSSION

Developing countries are in a period of epidemiological transition with the burden of cardiovascular diseases and type 2 diabetes mellitus increasing as the population is ageing.[13] Urbanization appears to be associated with extreme changes in dietary habits, psychological stress, and physical inactivity.[13–15]

Our data showed that the pattern of lipid abnormalities and prevalence of dyslipidemia were different between urban and rural communities. The prevalence of borderline high/high TC, TG and LDL-C were higher in urban than rural participants, while the prevalence of low HDL-C was higher in the urban participants also. This difference could be partially explained by differences in diet. Urban participants might be less active and consume unhealthy food containing more saturated fat and high calorie diet, while rural participants eat the traditional high carbohydrate, low protein and low fat diet.[6,13] The former diet is generally perceived as a symbol of affluence, particularly in urban areas.

Isezuo et al[16] found a prevalence of 31.1% and 20.8% for hypertriglyceridemia and hypercholesterolemia, respectively, in patients attending a tertiary health institution in Sokoto. These higher prevalence rates may be because the study was hospital based and the study population had hypertension with or without diabetes mellitus.

Increasing age is a known risk factor for development of dyslipidemia.[17] In our study the mean TC, LDL-C and TG levels generally increased with advancing age. Ageing can lead to increased sedentary living, excessive food consumption, reduced cholesterol metabolism, and thus increased accumulation of body lipids. This finding is in keeping with the reports of Elizabeth et al[18] who found that the proportion of dyslipidemic patients was low in the young age group up to an age of 20 years and peaked in the age group of 61–70 years in both sexes before a gradual decline thereafter.

Obesity is one of the important modifiable risk factors in the etiology of dyslipidemia.[3,19] Abdominal and global obesity were significantly higher among the urban than rural participants. Several previous studies showed that the

Table 4. Serum lipids values by age and location, mean (SD), mg/dL

	TC		TG		HDL-C		LDL-C	
Age, years	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
16–25	163.0 (12.4)	140.5 (25.1)	88.8 (24.9)	104.1 (37.8)	49.5 (8.8)	52.4 (5.2)	101.9 (14.1)	76.9 (22.4)
26–35	160.3 (27.2)	148.1 (17.8)	95.9 (24.5)	102.8 (37.4)	50.2 (9.1)	55.9 (6.4)	91.2 (25.9)	88.9 (18.6)
36–45	171.8 (19.4)	156.5 (29.5)	124.4 (44.6)	99.2 (33.3)	52.3 (8.8)	48.2 (11.2)	105.5 (46.7)	94.5 (32.3)
46–55	193.5 (45.7)	164.5 (38.8)	143.4 (52.7)	117.5 (37.1)	49.2 (20.3)	50.9 (13.3)	108.9 (50.5)	105.1 (30.3)
56–65	194.2 (92.1)	132.8 (38.4)	96.3 (38.5)	102.1 (38)	50.1 (9.6)	47.2 (13.1)	119.7 (90.2)	84.8 (28.9)

TC, total cholesterol; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; TG, triglyceride.

Table 5. Prevalence of dyslipidemia using NCEP ATP III in urban and rural participants, *n* (%)

ATP III Classification	Urban	Rural
LDL cholesterol		
100–129 near optimal	16 (32)	13 (26)
130–159 borderline high	6 (12)	3 (6)
160–189 high	3 (6)	0 (0)
≥190 very high	1 (2)	0 (0)
Total cholesterol		
<200 desirable	42 (84)	49 (98)
200–239 borderline high	5 (10)	1 (2)
≥240 high	3 (6)	0 (0)
HDL cholesterol		
<40 low	8 (16)	5 (10)
>60 high	7 (14)	5 (10)
Triglyceride		
150–199 borderline high	7 (14)	5 (10)
200–249 high	2 (4)	0 (0)
≥250 very high	0 (0)	0 (0)

risk of dyslipidemia rose with increasing BMI and waist circumference.[19–22]

Our data also showed that the rural-urban difference in plasma lipid levels in Hausa-Fulani is similar to that of other African countries and other developing countries.[14,23–25]

Study Limitations

The descriptive nature of our study is recognized by the researchers and this should stimulate the need for analytical and longitudinal studies for reliable conclusions to be made. Another limitation is the lack of data reported on use of lipid lowering therapy.

The prevalence of obesity and dyslipidemia are higher in urban than in rural dwelling populations in Sokoto in North-Western Nigeria.

CONCLUSION

The prevalence of obesity and dyslipidemia are higher in urban than in rural dwelling populations in Sokoto in North-Western Nigeria. These findings have implications for the pattern of lipid-based cardiovascular diseases and underscore the need for public screening as a tool for early diagnosis of lipid abnormalities and institution of appropriate treatment and preventive measures.

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